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Solar absorbers

# Absorption surfaces

# Get the most out of the sun



mirotherm® Control, mirotherm®, eta plus®, and mirosol® TS are the selective absorber coatings for solar thermal applications. They are designed to fulfill all requirements of the different applications. Solar absorption rates of up to 97% and emission rates as low as 4% are achieved.

Aluminium or copper is used as a substrate. mirotherm® Control, eta plus® and mirotherm® are manufactured in production lines operating in coil-to-coil and employing the **Physical Vapour Deposition** technology (PVD). mirosol® TS is an absorber coating based on a paint with solar selective properties. It is produced in a lacquering line operated in coil-to-coil.

## Your advantages

- 10-year material warranty
- Selective coating system ensures maximum absorption and lowest emission
- All standard joining technologies can be used
- Deliverable with a protective film; paper interleave available upon request
- State-of-the-art, in-line continuous monitoring of absorber optical properties guarantees highest quality
- Environmentally friendly / emission-free manufacturing process
- Low energy-amortisation period



Hamdan Sports Complex, Dubai, UAE, with 1,026 m<sup>2</sup> flat plate collectors to heat swimming pools, under floor heating and domestic hot water



## Absorption applications

The absorbing products are used in a wide range of solar-thermal collectors:

- Flat plate collectors
- Vacuum tube collectors

Mostly copper or aluminium tubes are welded to the rear side of the absorber substrate. Laser welding technology is commonly used for the welding process. It ensures a long-term mechanical stability and an excellent thermal conductivity.



Building at Burj Khalifa, Dubai, UAE with solar flat plate collectors using mirotherm®

# Solar coatings

## get smart



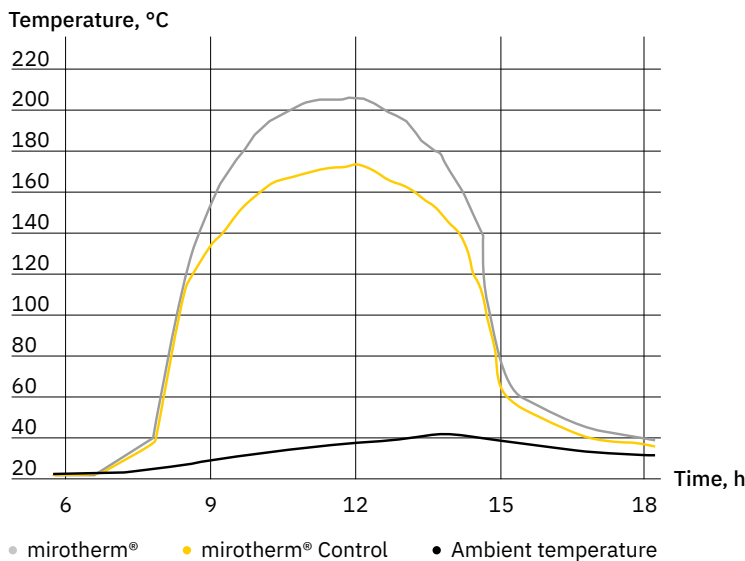
### mirotherm® Control

mirotherm® Control offers you many smart advantages: integrated protection against overheating, solar absorption of up to 97 %, highest product quality and resistance to external influences such as moisture. It was developed on the basis of our best-selling and established coating mirotherm®, a proven system.

#### Quick Info

- Overheating protection
- Up to 97 % solar absorption
- Up to 40 °C lower stagnation temperature compared to standard systems
- Smart reaction to temperature influences
- Reverse side treatment optimised for laser welding

Absorber temperature in a typical flat plate collector during the daytime (without load)



### Product advantages

- Overheating protection
- Significant reduction of fogging issues from insulation
- Less stress on collector components such as welding dots, plastic parts and the collector frame, which results in increased system reliability
- Low absorber deformation under stagnation. Prevents mechanical coating damage due to contact with glass
- Process and handling identical to mirotherm
- Qualified according to ISO/EN 22975-3 (Task X)



## mirotherm®

mirotherm® was presented twenty years ago. An innovative three-layer absorber stack is deposited on the front side of the substrate using PVD technology in an air-vacuum-air production line. Whilst the IR-reflective layer ensures low thermal emissivity, the oxide absorption layer combined with an antireflection layer provides maximum solar absorption of up to 96% and resistance to external influences.

It was the first commercially available solar selective absorber coating on aluminium substrate produced with PVD technology. More than 21 Mio m<sup>2</sup> were sold during the last 20 years. An electrochemical treatment of the aluminium on both sides prior to the coating deposition ensures excellent adhesion of the solar coating and high corrosion resistance. In addition, the treatment of the reverse side maximises the laser beam absorption during the welding process.

### Quick Info

- Proven quality with over 20 years experience
- Up to 96 % solar absorption
- Reverse side treatment optimised for laser welding





## eta plus®

eta plus® is our fully sputtered product for solar thermal applications and it is available on aluminium and copper. It can be used in flat-plate collectors with full-surface or strip absorbers, in tube collectors as well as in air and large-scale facade collectors. In addition, it facilitates the production of high-performance collectors for solar cooling or for process heat generation.

eta plus® achieves a very high solar absorption of 96 % – combined with a very low thermal emissivity of just 4 %. It is deposited on aluminium or copper strips using the PVD technology in an air-vacuum-air production line.

### Quick Info

- Available on copper and aluminium
- Up to 96 % solar absorption
- Suitable for laser and/or ultrasonic welding



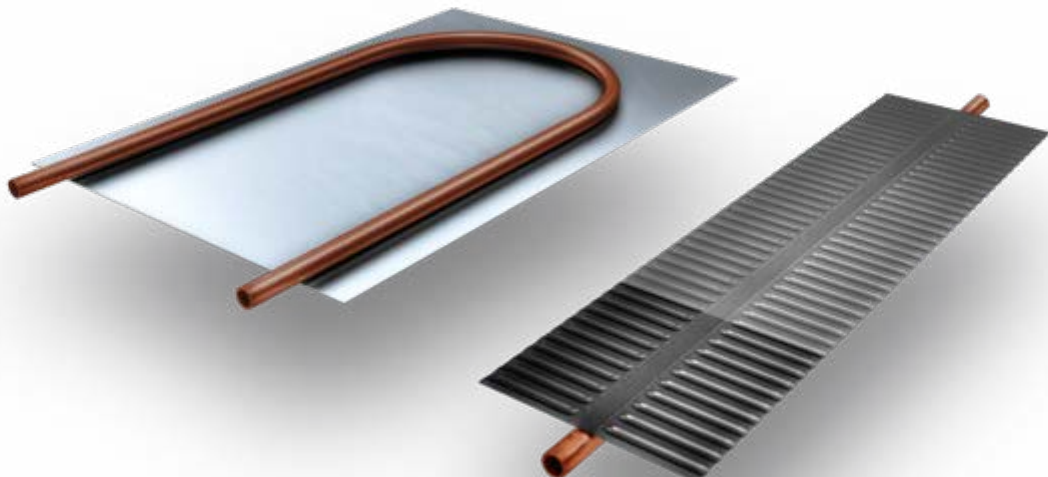
## mirosol® TS

In addition to PVD coatings, lacquers using the coil coating method are now also available for solar thermal collectors. mirosol® TS is the ideal material for your solar thermal systems installed in regions with high solar radiation. During the fabrication of mirosol® TS, a lacquer consisting of inorganic pigments, functionalised by aminosilane, is applied onto aluminium. A specially developed lacquering process is employed.

mirosol® TS offers you high resistance to heavy environmental pollution, salty air, moisture, condensation, oil and dirt as well as a low stagnation temperature.

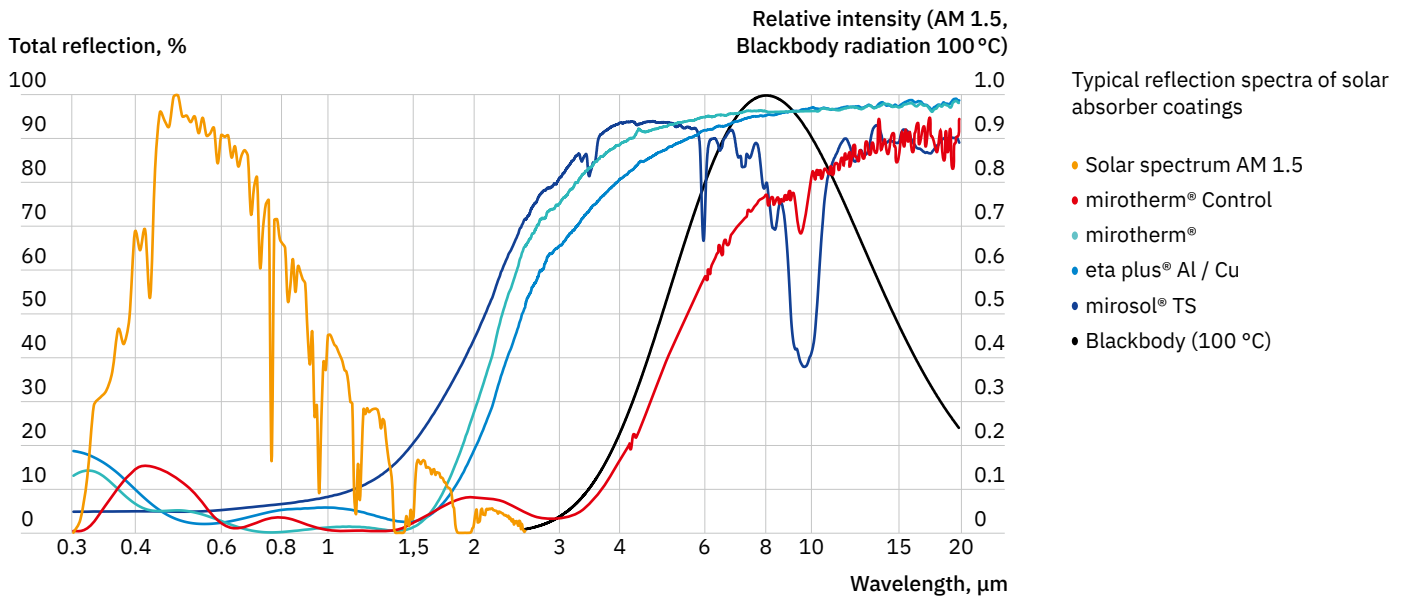
### Quick Info

- High corrosion resistance
- Suitable for laser and/or ultrasonic welding
- Available on aluminium
- Hydrophobic
- Not sensitive to fingerprints





## Technical Specifications



Product	mirotherm® Control	mirotherm®	eta plus® Al	eta plus® Cu	mirosol® TS
<b>Mechanical</b>					
Alloy	Al 1.050 or purer <sup>1)</sup>	Al 1.050 or purer <sup>1)</sup>	Al 1.050 or purer <sup>1)</sup>	Cu-DHP, Cu-OF, Cu-HCP <sup>2)</sup>	Al 1.050 or purer <sup>1)</sup>
Hardness	hard <sup>3)</sup>	hard <sup>3)</sup>	hard <sup>3)</sup>	hard <sup>4)</sup>	half hard <sup>3)</sup>
<b>Optical</b>					
Solar absorption, $\alpha_{\text{sol}}$	0.96 ± 0.01	0.95 ± 0.01	0.95 ± 0.02	0.95 ± 0.02	0.90 ± 0.02
Thermal emission, $\epsilon_{100\text{ °C}}$	temperature dependent	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.02	0.20 ± 0.03
Colour coordinate a* (D 65)	-12 to +10	-12 to 0 <sup>5)</sup>	0 to +14	0 to +14	-1 to +2 <sup>5)</sup>
Colour coordinate b* (D 65)	-36 to -20	-25 to 0 <sup>5)</sup>	-35 to -10	-35 to -10	-1 to +2 <sup>5)</sup>
<b>Physical</b>					
Heat conductivity [W/(m · K)]	210–220	210–220	210–220	295–395	210–220
Specific weight [g/cm <sup>3</sup> ]	2.7	2.7	2.7	8.9	2.7
<b>Dimensions</b>					
Width [mm/inch]	max. 1,250 / 49.21	max. 1,250 / 49.21	max. 1,250 / 49.21	max. 1,250 / 49.21	max. 1,250 / 49.21
Thickness [mm/inch]	0.2–0.5 <sup>7)</sup> / 0.008–0.020 <sup>7)</sup>	0.2–0.5 <sup>7)</sup> / 0.008–0.020 <sup>7)</sup>	0.2–0.5 <sup>7)</sup> / 0.008–0.020 <sup>7)</sup>	0.12–0.3 <sup>7)</sup> / 0.0047–0.012 <sup>7)</sup>	0.2–0.5 <sup>7)</sup> / 0.008–0.020 <sup>7)</sup>
<b>Delivery</b>					
Coils or sheets with	paper interleave or protection foil	paper interleave or protection foil	paper interleave or protection foil	paper interleave or protection foil	paper interleave or protection foil
Inner diameter [mm]	400 or 500	400 or 500	400 or 500	400 or 500	400 or 500
<b>Aging test &amp; Warranty</b>					
Aging test <sup>6)</sup>	passed	passed	passed	passed	passed
Warranty	10 years	10 years	10 years	10 years	10 years

<sup>1)</sup> DIN EN 573-3, <sup>2)</sup> DIN EN 13599, <sup>3)</sup> DIN EN 485-2, <sup>4)</sup> DIN EN 1652, <sup>5)</sup> DIN 5033, <sup>6)</sup> ISO 22975-3:2014, <sup>7)</sup> Other thicknesses on request

## Care for the Environment

Conserving natural resources has been part of our corporate philosophy ever since our company was founded in 1975. Today, Alanod is a climate-neutral, sustainably run company. Due to the excellent recycling properties of aluminium, our materials use up to 90 % recycled aluminium. This consumes up to 95 % less energy compared to primary aluminium production.

Our cutting-edge post-combustion technology enables production of all of our materials without the need for excessive energy input. All our electricity needs are met using “100 % green” energy sources.

## Made in Germany

Our high-tech materials are all manufactured at our sites in Germany.

## System Development

Our broad-based team of experts develops individual solutions for our customers in close cooperation with international research institutions and long-standing industrial partners. Talk to us so that we can work together to fulfill your wishes.



**ALANOD GmbH & Co. KG**

Egerstr. 12, 58256 Ennepetal, Germany

+49 2333 986 - 500

info@alanod.de · solar@alanod.de

alanod.com · solar.alanod.com